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MAT 104 ASSIGNMENT

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✓ Civil Engineering
✓ 19/ENG03/005
✓ MAT 104 Assignment

1. $y = \frac{2\cos 3x}{x^3}$

let $u = 2\cos 3x$, $v = x^3$

$\frac{du}{dx} = -6\sin 3x$, $\frac{dv}{dx} = 3x^2$

$\frac{dy}{dx} = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

$\frac{x^3(-6\sin 3x) - 2\cos 3x(3x^2)}{x^6}$

$\frac{dy}{dx} = \frac{-6x^2(x\sin 3x - \cos 3x)}{x^6}$

2. $y = xe^{2x}$

show that $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$

Let $u = x$, $v = e^{2x}$

$\frac{du}{dx} = 1$, $\frac{dv}{dx} = 2e^{2x}$

$\frac{dy}{dx} \Rightarrow e^{2x} + 2xe^{2x}$

$\frac{dy}{dx} = e^{2x} + 2xe^{2x}$

$\frac{d^2y}{dx^2} = 2e^{2x} + \frac{d}{dx}(2xe^{2x})$

$= 2e^{2x} + 2e^{2x} + 4xe^{2x}$

$\frac{d^2y}{dx^2} = 4e^{2x} + 4xe^{2x}$

$4\frac{dy}{dx} = 4(e^{2x} + 2xe^{2x}) \Rightarrow 4e^{2x} + 8xe^{2x}$

$4y = 4(xe^{2x}) \Rightarrow 4xe^{2x}$

Then $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$

$(4e^{2x} + 4xe^{2x}) - (4e^{2x} + 8xe^{2x}) + 4xe^{2x} = 0$

$\therefore \frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$ is correct

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(4) $\int e^x \sin 2x$

$v = e^x$ and $du = \sin 2x$

$dv = e^x dx$, $u = \frac{-\cos 2x}{2}$

$\int v\,du = uv - \int u\,dv$

$\int e^x \sin 2x = \frac{-e^x \cos 2x}{2} + \int \frac{e^x \cos 2x}{2}$

$\int \frac{e^x \cos 2x}{2} = \frac{1}{2}\int e^x \cos 2x$

$\int e^x \cos 2x = \left(\frac{e^x \sin 2x}{2} - \int \frac{e^x \sin 2x}{2}\right)\frac{1}{2}$

$\int e^x \sin 2x = \frac{e^x \sin 2x}{4} - \frac{e^x \cos 2x}{2} - \int \frac{e^x \sin 2x}{4}$

let $\int e^x \sin 2x$ be y

$$y = \frac{e^x \sin 2x}{4} - \frac{e^x \cos 2x}{2} - \frac{4}{4} + c$$

$$\frac{5y}{4} = \frac{e^x \sin 2x}{4} - \frac{e^x \cos 2x}{2} + c$$

$$5y = e^x \sin 2x - 2e^x \cos 2x + c$$

$$y = \frac{e^x \sin 2x - 2e^x \cos 2x + c}{5}$$

Putting the value of y back

$$\int e^x \sin 2x = \frac{e^x \sin 2x - 2e^x \cos 2x + c}{5}$$